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Alternative Fuels: FT SPK and HRJ for Military Use

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- Two alternative fuels for which evaluations are being completed to assess their impacts on tactical ground systems
 - Blends of JP-8 and up to 50% by volume of
 - Fischer-Tropsch Synthetic Paraffinic Kerosene (FT SPK)
 - Hydroprocessed Renewable Jet (HRJ)
 - Both products (FT SPK and HRJ) are very similar compositionally
 - Resultant properties are very similar
 - Evaluations thus conducted using one of these blends will be representative of evaluations for the other by similarity
 - Evaluations are conducted using nominal 50:50 blends (volumetric basis)
- Several types of evaluations already completed or planned
 - Laboratory bench-top testing
 - Rig testing of fuel injection systems
 - Tactical vehicle engine testing
 - Pilot demonstrations in tactical ground systems (vehicles, force projection equipment, generator sets)

- Tactical Wheeled Vehicle Pilot Field Demo conducted at Ft. Bliss, TX (2009)
 - Half of fleet on JP-8, other half on synthetic fuel blend
 - Miles driven per driver training protocol
 - No issues, no discernible differences of vehicle performance/maintenance between the fuels
- HMMWV Test Track Evaluation (2009)
 - GEP 6.5L non-turbo evaluated
 - Loaded vs. unloaded, uphill vs. flat vs. downhill, on-road vs. off-road
 - Test fuels: DF2, JP-8, FT SPK, and FT SPK/JP-8 blend
 - Noticeable acceleration loss using blend
- Tactical Generator Set Pilot Demo (2007)
 - Three 10-kW generator sets in side-by-side operation
 - 1000 hours total test time each
 - Test fuels: DF2 (break-in), JP-8, FT SPK, and FT SPK/JP-8 blend
 - No issues



TARDEC photo by R. Alvarez,
TARDEC Fuels & Lubricants Research Facility

6.5L Turbo Engine

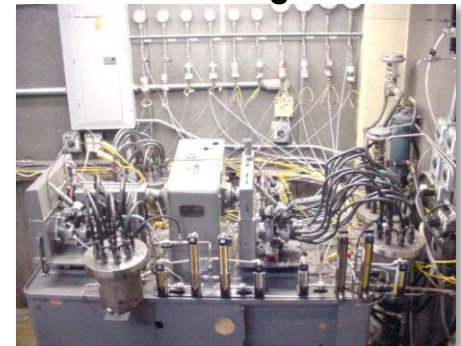
- Endurance testing of tactical vehicle engines
- NATO 400-Hour Cycle testing conducted at TARDEC Propulsion Lab (2008-2009)
 - Engines tested (2008-2009)
 - GEP 6.5L Turbo (HMMWV)
 - CAT 7.2L Engine (Stryker, FMTV)
 - Power curves generated at start of, during, and at end of test
 - Testing at elevated/desert temperatures whenever possible
 - Test fuels: JP-8 (baseline) and FT SPK/JP-8 Blend
 - All engines passed NATO Protocol
- Army/CRC 210-Hour Wheeled Vehicle Cycle testing conducted at TARDEC Fuels & Lubricants Facility (2007)
 - CAT 7.2L Engine (Stryker, FMTV)
 - Twice through (2X) 210-hr test cycle performed using FT SPK (100%)
 - Power curves generated at start and end of test for ULSD, JP-8, FT SPK, FT SPK/JP-8 blend
 - No issues



TARDEC photo

- Laboratory evaluations of FT SPK
 - Elastomer Compatibility / O-ring Studies (2003-2006)
 - Fuel Blend Studies (2005-2006)
 - Cetane Study (2008-2009)
 - Measured, calculated, and derived
 - Lubricity Study (2008-2009)
 - BOCLE, SLBOCLE, and HFRR
- Rotary injection fuel pump evaluation (2004)
 - FT SPK neat and FT SPK treated with military-approved lubricity improver additive (CI/LI)
 - Testing not done at elevated temperatures
 - Pump failure after just 96 hours with untreated FT SPK
 - Pump ran full test (500 hours) with treated FT SPK

Rotary fuel injection pump
test rig



TARDEC photo by E. Frame,
TARDEC Fuels & Lubricants Research Facility

- NATO 400-Hour Cycle testing of selected tactical vehicle engines (HRJ/JP-8 blend)
 - DDC 8V92TA (HEMTT)
 - Cummins 903C (Bradley)
 - Continental 1790 (Recovery Vehicle)
 - MaxxForce (MRAP)
- Rotary injection fuel pump testing, high temperature (FT SPK/JP-8 blend)
- High pressure common rail fuel system testing (blends of FT SPK or HRJ with JP-8)
- Tactical generator sets, 10 kW to 100 kW sizes (HRJ/JP-8 Blend)
 - In coordination with CERDEC
 - 1500-hour reliability testing
 - Other performance testing (electrical characteristics, fuel consumption, etc.)
- Pilot field demonstration of Force Projection equipment operating on fuel blend (HRJ/JP-8 Blend)